Aivon Oy

Manual

QuadBattSwitch

Battery switching device

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Battery switching device

Aivon QuadBattSwitch is a switch that performs swapping between eight batteries in four battery pairs. In any time, one pair member is being discharged by user and the other member is being recharged by a battery charger. Swapping takes place in intervals of 12, 24 or 48 hours. User can also manually swap the batteries after which the time counter resets and the selected period is used.

With the help of a large storage capacitor the output voltage stays constant during swap. Thus, QuadBattSwitch provides an "endless" and uninterruptible four-battery source that can be used in various applications, such as preamplifier powering in sensitive measurements.

Main features

- Four battery pairs providing four 12V endless battery outputs
    - Option for 2 battery pairs
    - Batteries (12V lead-acid) are selected and purchased by customer
    - Other battery types possible upon request
- One charger per each battery pair
    - Mounted outside the enclosure
    - Chargers suitable for batteries are purchased by customer
- Mechanical button switch to control the swapping period
    - 12, 24 or 48 hour period shown by led indicators
    - Other periods upon request
    - Leds indicating when the swapping takes place in next 6 hours and 1 hour
- Mechanical button switch to operate the immediate swapping
    - Led indicators show the battery (A or B) under discharge (other battery is automatically recharged if battery charger is connected)
- Terminal block connectors (pitch 3.81 mm) in rear panel for battery pairs, chargers and endless outputs (if external)
- Output voltages available also in front panel Binder connector (8-pins)
    - Other connector upon request
    - Led indicators showing battery voltages
    - Monitor connector for probing battery voltages. Each output voltage available in every other row. Resistor protected, no current output.
- Option for internal linear voltage regulators to form stable and constant voltage source of e.g. bipolar +/- 12V or 15V.

- 19" rack mountable, 1U height

- 2.5mm 12Vdc barrel connector for powering the control electronics incl. relays. Separate ac/dc adapter provided with European wall plug. This voltage supply is only needed for swapping the batteries. If this supply is disconnected, BattSwitch will still provide output voltage from selected batteries and charge the other batteries.

Basic layout

Figure 1: Two identical boards for 2 battery pairs including relays and storage capacitor. Glass fuses next to rear panel.

Figure 1 shows the basic layout of four battery pair QuadBattSwitch. In front panel there is a main circuit board that controls two identical relay boards for 2 battery pairs each.

Connections

The main and relay boards require 12Vdc power. A pushbutton switch is used to control swapping. In "A in use" position, battery A is discharged and B is recharged. In "B in use" position the roles are interchanged. All batteries are swapped simultaneously. This voltage supply is only needed for swapping the batteries. If this supply is disconnected, BattSwitch will still provide output voltage from selected batteries and charge the other batteries. When power supply is introduced, the unit goes to always to initial state (12 hour period, A in use, B recharged).

Figure 2: Button switches for swap period, manual swap and power input connector for ac/dc adapter.

Figure 3: Battery, output and charger terminal block connectors in rear panel. This model has place for four battery pairs.

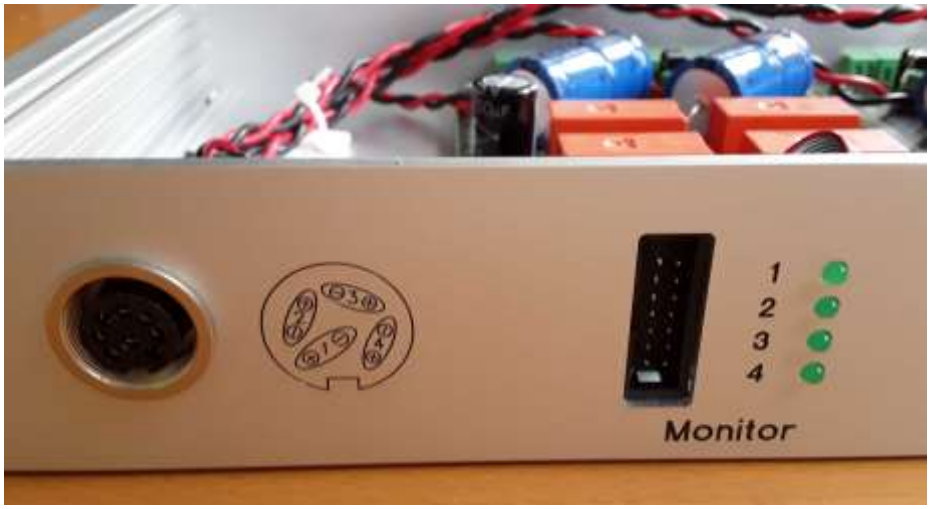

Figure 4: Battery output and monitor connectors. Each battery pair has output pins in circular Binder connector and 2.54 mm pin header (every other row).

Option: Voltage regulator unit

Instead of front panel output connector for endless battery voltages, a linear voltage regulator can be added to provide constant and stable output voltage for the user. Two 12V battery pairs can be arranged in series to form a bipolar +/-12V regulated voltage (maximum current 0.5A). Also other voltages/currents are possible depending on number of available battery pairs. The output voltages (regulated or unregulated) are provided by the batteries and thus floating. They should be suitably grounded by the user. We also recommend grounding of the enclosure.

Figure 5: Voltage regulator connectors in front panel. Leds indicate the availability of sufficient battery voltage.

Figure 6: Voltage regulator unit with fuses. If there is no voltage at the regulator output but the leds are on (and regulator switch is on), check the fuses.

Measurements

We added 10 mF electrolytic capacitors to store battery charge during swapping. We also discharged the "endless" output via 2 x 10 Ohm resistors in series. In reality, the raw battery voltage is about 13V and thus the discharge rate was 0.65 A. The following figures show the voltage across one 10 Ohm resistor. Multiply by two the get the full voltage.

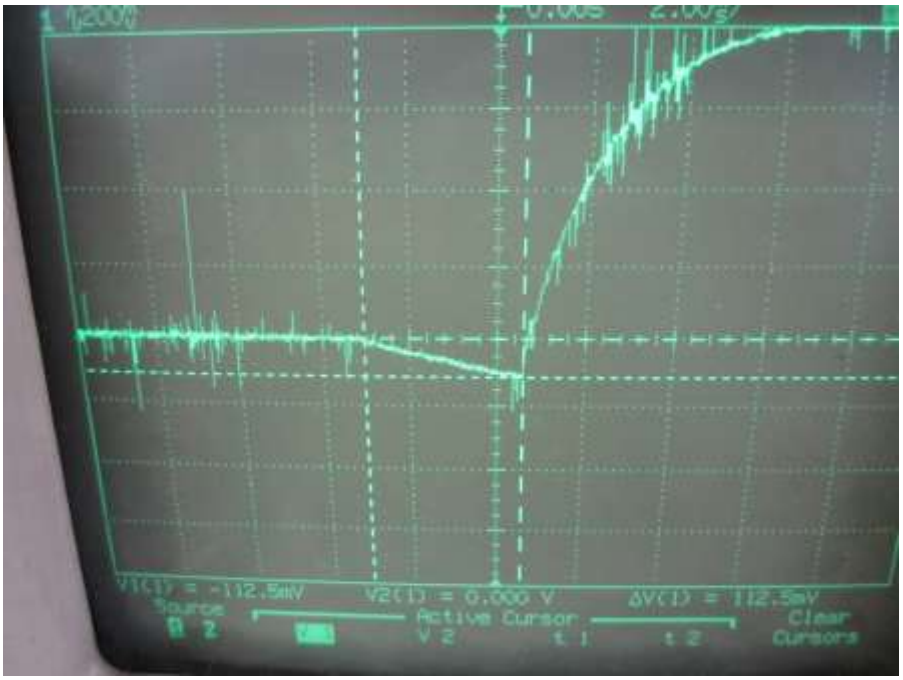

Figure 7: Swapping from A position to B position. Starting from initial level of battery A (about 0.5 x 12.6V) the output voltage drops 113 mV during a swap that lasts 4 ms. After this, the other battery B is powering the output. The final level is higher because battery B was recharged before the swap and thus its voltage is initially higher. Y-scale is 200 mV / division. In long timescale, the output voltage will slowly drop to about 12.5 V and below. The duration depends on the capacity of the batteries and the discharge rate. E.g. 12 Ah batteries can provide 0.5A for 24 hours.

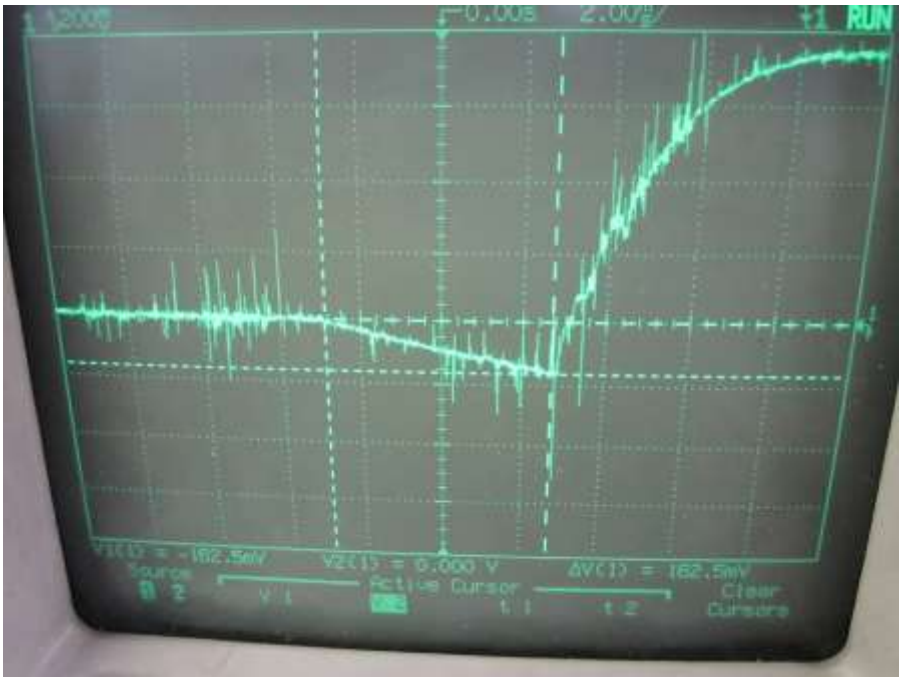

Figure 8: Swapping from B position to A position. Starting from initial level of battery B (about 0.5 x 12.6V) the output voltage drops 163 mV during a swap that lasts 6 ms. After this, the other battery A is powering the output. The final level is higher because battery A was recharged before the swap and thus its voltage is initially higher.

We conclude that with storage capacitors the BattSwitch provides endless and uninterruptible voltage source that can be further regulated to meet the needs of the user. During the swap, the unregulated voltage output drops about 330 mV even if it is discharged by 0.65 Amperes. If the discharge rate is less, the voltage drop is smaller by the same ratio. If followed by voltage regulator that has low enough dropout voltage **the regulated output will not drop at all**.

Without storage capacitors the output voltage goes to zero during the swap as shown in the following figure.

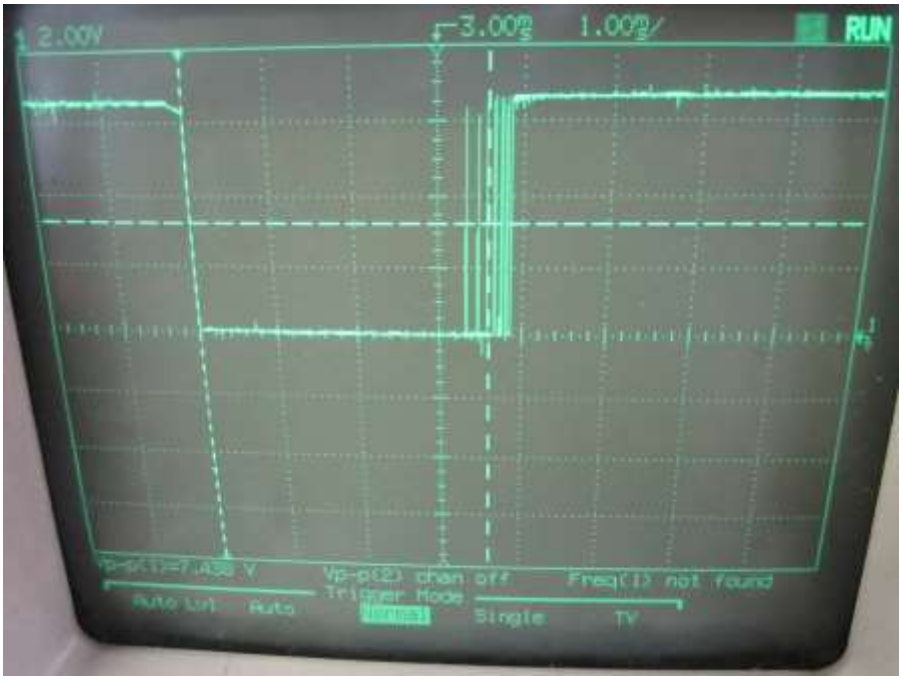

Figure 9: Without storage capacitors. Switching from A to B lasts 4 ms but the output voltage drops immediately to zero. This interrupts the power supply and may disturb sensitive measurements. Y-scale is 2 Volts / division.

Specifications

Enclosure

Material	Anodized aluminum.
Front panel battery connector	Binder 680, 8 pins, product nr. 09 0474 00 08
Rear panel connector	Terminal block, 3.81 mm, 2-way Mates with e.g. IMO Precision controls 21.1550M/2-E or Camdenboss CTBP92HE/2

Physical dimensions

Enclosure dimensions (Width x height x depth)	483 mm x 50 mm x 190 mm
Weight (w/o ac adapter)	1.7 kg

Document revision history

Date	Version	Description	Author
24.7.2018	0.1	Initial draft	JSP